



Pinellas Environmental Restoration Project

Quarterly Progress Report for the Young - Rainey STAR Center's 4.5 Acre Site October Through December 2005

January 2006



Office of Legacy Management

**Pinellas Environmental Restoration Project
Quarterly Progress Report
4.5 Acre Site**

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January 2006

Work Performed by S.M. Stoller Corporation under DOE Contract No. DE-AC01-02GJ79491
for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado

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December 2005

Acronyms and Abbreviations

bls	below land surface
COPC	contaminants of potential concern
DCE	dichloroethene
DOE	U.S. Department of Energy
DPE	dual-phase extraction
FDEP	Florida Department of Environmental Protection
ft	feet
IRA	Interim Remedial Action
µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
mg/L	milligrams per liter
mV	millivolts
NGVD	national geodetic vertical datum
NTU	Nephelometric Turbidity Units
RPD	relative percent difference
STAR Center	Young - Rainey Science, Technology, and Research Center
TCE	trichloroethene
TCOPC	total contaminants of potential concern
VC	vinyl chloride
VOCs	volatile organic compounds

1.0 Introduction

The *Pinellas Environmental Restoration Project Quarterly Progress Report for the 4.5 Acre Site* describes environmental restoration activities for the Pinellas 4.5 Acre Site located in Pinellas County, Largo, Florida. The former U.S. Department of Energy (DOE) Pinellas Plant facility consisted of the 4.5 Acre Site and the Young - Rainey Science, Technology, and Research Center (STAR Center) ([Figure 1](#)). The facility was constructed in the mid-1950s as part of a nationwide nuclear weapons research, development, and production complex. Production of weapons-related components ceased in September 1994. However, as a result of these operations, contamination exists in the surficial ground water beneath the Site.

Administration of DOE activities at the 4.5 Acre Site is the responsibility of the DOE Office of Legacy Management in Grand Junction, Colorado. S.M. Stoller Corporation (Stoller), a prime contractor to DOE's Office of Legacy Management in Grand Junction, provides technical support to DOE for remediation and closure of all active solid-waste management units on site and for the 4.5 Acre Site.

The 4.5 Acre Site is located to the northwest of the STAR Center, in the northeast quarter of Section 13, Township 30 South, Range 15 East ([Figure 2](#)). This parcel was owned by DOE from 1957 to 1972, at which time it was sold to a private landowner. During the period of DOE ownership, the property was used for disposal of drums of waste resins and solvents. As a result of this practice, the surficial aquifer was impacted by volatile organic compounds (VOCs), primarily vinyl chloride (VC), toluene, trichloroethene (TCE), and 1,2-dichloroethene (DCE). DOE completed a source removal in 1985.

An Interim Remedial Action (IRA) consisting of ground water extraction and treatment via air stripping, and a routine ground water monitoring program were initiated in May 1990. In July 1997, a modification of the IRA involving installation of dual-phase extraction (DPE) wells provided a more aggressive system to remove ground water contamination. In November 1999, the DPE/air-stripping system was replaced with an in-situ biosparging treatment system.

Currently, ground water cleanup is proceeding according to provisions in the document *Remediation Agreement for the Four and One-Half Acre Site in Largo, Pinellas County, Florida* (Remediation Agreement) (DOE 2001b), an agreement between DOE and the Florida Department of Environmental Protection (FDEP); and in accordance with applicable portions of "Corrective Actions for Contamination Site Cases," an appendix to FDEP's *Enforcement Manual* (FDEP 1999).

The *4.5 Acre Site Biosparging System Integration Plan* (DOE 2000) was approved by FDEP on January 17, 2001. This plan states that performance monitoring would be undertaken on a quarterly basis. Therefore, in April 2001, performance monitoring of the remedial system through the use of direct push technology was undertaken. However, the biosparging systems were shut off in May 2003 with no plans to restart them and no performance monitoring data have been collected since April 2003. Subsequent monitoring has been adapted to fit the new remediation scenario and performance monitoring as defined in the *Interim Remedial Action Plan for Ground Water Recovery at the 4.5 Acre Site* (DOE 2003).

The IRA Plan for Ground Water Recovery at the 4.5 Acre Site was submitted to FDEP on August 29, 2003, and approved by FDEP on September 19, 2003. Implementation of the IRA Plan commenced on March 8, 2004, when construction activities began on the IRA treatment system. The treatment system consists of an extraction well field (three recovery wells), pumps and associated piping, transmission water pipeline, utility connection, a low profile tray air stripper unit, and effluent piping. The new IRA system began operations on April 26, 2004.

The IRA system is a temporary measure that was outlined in the *Remedial Action Plan for the Pinellas 4.5 Acre Site* (DOE 2001a) as a contingency option in the event that biosparging resulted in extending the contaminant plume. In April 2005, the *Pinellas Environmental Restoration Project 4.5 Acre Site Remedial Action Plan (RAP) Addendum* was submitted to FDEP. This document presented a proposed final action for the 4.5 Acre Site that involves closure of the site using the provisions of the recently adopted State of Florida Global Risk Based Corrective Action regulations.

Technical discussions between FDEP and DOE regarding the proposed final action continue. Part of DOE's proposed final action for the 4.5 Acre Site was to shut down the IRA system and begin a 2-year monitoring period. Approval from FDEP to shut down the IRA system was received on December 21, 2005, thus commencing the DOE's 2-year monitoring period.

This document is the quarterly progress report for the 4.5 Acre Site for October through December 2005, as requested by FDEP. The results of monitoring activities and a summary of ongoing and projected work are provided in this report.

1.1 Quarterly Site Activities

Obtained water-level measurements from all monitoring wells on October 14, 2005.

Conducted the quarterly sampling event (i.e., collected ground water samples from 32 monitoring wells and three recovery wells) in October 2005. Thirty-five wells were sampled for VOCs and analyzed using U.S. Environmental Protection Agency (EPA) SW-846 Method 8260. Two wells were sampled for arsenic and analyzed using EPA SW-846 Method 6010. Ten wells were sampled for biological remediation parameters.

Reported the results of this quarterly sampling event (this document).

2.0 Monitoring Data

2.1 Ground Water Elevations and Flow

Within a 2-hour period on October 14, 2005, depth-to-water measurements were taken in all monitoring wells at the 4.5 Acre Site as part of the sitewide quarterly sampling event. The depth to water in each well was measured with an electronic water-level indicator. The October ground water elevation data for the 4.5 Acre Site are listed in [Table 1](#). The data and information from deep wells were used to construct contours of water levels in the deep surficial aquifer in [Figure 3](#).

The interpretative contours on Figure 3 show ground water flow generally to the west-northwest. These flow patterns are consistent with those observed at the site during the previous 2 ½ years following shutdown of the biosparging system in May 2003. In addition, capture zones are apparent around the three recovery wells (RW01, RW02, and RW03) at the 4.5 Acre Site. These capture zones indicate that the ground water recovery system at the site is maintaining hydraulic control along the west fence line.

The water table ranged from about 4.0 to 8.0 feet below land surface (ft bls), with ground water elevations that ranged from a high of 14.55 ft at PIN20-M012 to a low of 10.56 ft at PIN20-M055. The hydraulic gradient across the site was approximately 0.008 feet per foot. This gradient is similar to those observed the past year. Using Darcy's Law, along with approximations of 1 ft/day for hydraulic conductivity and 0.3 for effective porosity, ground water at the site is estimated to move about 10 ft/year. This velocity is consistent with previously observed velocities of 3 to 10 ft/year.

2.2 Ground Water Sampling

Thirty-two monitoring and three recovery wells were sampled by Stoller personnel in October 2005. Thirty-five wells were sampled for VOCs, two wells were sampled for arsenic, and ten wells were sampled for bioremediation parameters.

All samples were collected in accordance with the *Pinellas Environmental Restoration Project Sampling Procedures for the Young - Rainey STAR Center and 4.5 Acre Site* (DOE 2004) using FDEP procedures. All samples collected were submitted to Accutest Laboratory for analysis. Accutest is accredited by the Florida Department of Health in accordance with the National Environmental Laboratory Accreditation Conference, certification number E83510. VOCs were analyzed using EPA SW-846 Method 8260 and arsenic was analyzed using EPA Method 6010.

All of the monitoring wells were micropurged with dedicated bladder pumps and samples were collected when the field measurements stabilized. Extraction wells were sampled using their associated flowlines with dedicated sampling ports. [Table 2](#) lists measurements of pH, specific conductance, dissolved oxygen, oxidation/reduction potential, turbidity, and temperature recorded at the time each sample was collected. These measurements were collected using a flow cell and multiparameter meter.

2.3 Ground Water Analytical Results

Individual contaminants of potential concern (COPC) and total COPCs (TCOPCs) concentrations in samples collected from wells at the 4.5 Acre Site are included in [Table 3](#). Arsenic data are shown on [Table 4](#). The previous four quarters of results are included in Table 3 for comparison. [Figure 4](#) shows the TCOPCs concentrations for July 2005.

No COPCs were detected in samples from the 12 sample locations listed below (results listed in Table 3).

PIN20-M015	PIN20-M025	PIN20-M22D	PIN20-M40S
PIN20-M023	PIN20-M036	PIN20-M38D	PIN20-M41D
PIN20-M024	PIN20-M055	PIN20-M40D	PIN20-RW01

Samples from 23 sample locations listed below contained COPCs at detectable levels (results listed in Table 3).

PIN20–0502	PIN20–M049	PIN20–M059	PIN20–M064	PIN20–MWL4
PIN20–0503	PIN20–M053	PIN20–M060	PIN20–M18D	PIN20–RW02
PIN20–M001	PIN20–M056	PIN20–M061	PIN20–MWL1	PIN20–RW03
PIN20–M019	PIN20–M057	PIN20–M062	PIN20–MWL2	
PIN20–M035	PIN20–M058	PIN20–M063	PIN20–MWL3	

The maximum TCOPCs value detected was 8,883 micrograms per liter ($\mu\text{g}/\text{L}$) at PIN20–M063. The compound detected at the highest concentration in PIN20–M063 was cis-1,2-DCE at a concentration of 4,890 $\mu\text{g}/\text{L}$. Reported “J” values are not considered in the TCOPC analyte concentrations. Arsenic was detected in PIN20–0502 and –0503 at concentrations of 0.0128 and 0.0303 milligrams per liter (mg/L), respectively.

Samples were also collected for dissolved gases and microbial activity analyses. The dissolved gases are ethene, ethane, hydrogen, methane, and carbon dioxide. The microbiological analysis is for dehalococcoides ethenogenes. Analytical results for these gases and this microorganism are summarized in [Table 5](#).

Laboratory reports for quarterly samples collected in October 2005 are provided in [Appendix A](#). IRA treatment system influent, effluent, and recovery well analytical results are provided in [Appendix B](#).

2.4 Quality Assurance/Quality Control

Three duplicate samples were compared to their paired sample and the relative percent differences (RPDs) between the results were calculated. Results of analyses for each duplicate sample are listed in [Table 6](#). From the three duplicate samples, 109 individual compounds were analyzed. All sample duplicate pairs meet the quality control criteria for RPD. All data are considered Class A level, indicating that the data may be appropriately used for quantitative and qualitative purposes.

According to the Stoller Sampling Procedures, duplicate samples should be collected at a frequency of one duplicate for every 20 or less samples. There were 35 VOC samples and three duplicate samples. There were two arsenic samples and one duplicate sample. The duplicate criterion was met.

Fifteen trip blanks were collected during this sampling event and all were nondetect for VOCs.

A data validation software module for identifying and tracking anomalous ground water data points within the SEEPro database was used this quarter. The software prints a report of analytical results that fall outside of historical minimum or maximum values. No anomalous results are being tracked from previous events. During this event several field parameter measurements were identified as anomalous. PIN20–0502 had higher oxidation reduction potential measured than during any previous sampling event, and PIN20–0502 and –M059 had higher dissolved oxygen measurements than previously measured. All three wells will be tracked during subsequent sampling events to assist in evaluating the anomalous data.

3.0 Treatment System and Recovery Well Operations

From October 1 through December 20, 2005, the treatment system processed 541,718 gallons of ground water. On December 20, operation of the recovery wells and treatment system was discontinued as discussed in Section 1.0.

For the month of October, 212,940 gallons of ground water were recovered and 0.01 pounds of VOC contaminants were removed. In November, 227,510 gallons of ground water were recovered and 0.01 pounds of VOC contaminants were removed. In December, 101,268 gallons of ground water were recovered and 0.01 pounds of VOC contaminants were removed. [Figure 5](#) presents the monthly volume of ground water recovered and mass of VOCs removed during this quarter from the 4.5 Acre Site recovery wells.

The treatment system experienced two outages during this quarter. In October, Hurricane Wilma struck the West Coast of Florida and overloaded the system with rainwater. The system was reset and resumed operations after personnel returned to the site. In December, the system was overloaded with rainwater over the weekend of December 17 and 18.

A summary of analytical results for samples collected at the 4.5 Acre Site treatment system during this quarter is provided in [Table 7](#). Treatment system influent and effluent samples were analyzed for VOCs and the effluent discharge volume was recorded to comply with the Pinellas County wastewater permit. In the effluent samples, all volatile organic aromatic concentrations were under the Pinellas County regulatory limit of 50 µg/L.

[Table 8](#) presents the average monthly concentration and the calculated mass of selected analytes processed by the 4.5 Acre Site treatment system for each month of this quarter. These monthly results are based on the measured system influent concentration and ground water flow.

FeRemede® was utilized at the new 4.5 Acre Site treatment system to control the deposition of iron and hardness salts in the air stripper. Additionally, sodium hypochlorite was utilized as a microbiocide to control biological growth in the air stripper.

4.0 Tasks to be Performed Semi-Annually

The following tasks are scheduled during the next semi-annual period (January 2006 through June 2006).

Semi-annual sampling and analysis of ground water in March 2006.

Collect water-level measurements in January 2006 and March 2006.

Shutdown of the IRA treatment system such that it can be restarted with minimal effort.

5.0 References

Florida Department of Environmental Protection (FDEP), 1999. "Corrective Actions for Contamination Site Cases," Appendix to FDEP *Enforcement Manual*, May.

DOE (U.S. Department of Energy), 2000. *4.5 Acre Site Biosparge System Integration Plan*, GJO-2000-182-TAR, MAC-PIN 25.5.1.1, prepared by U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, December.

DOE (U.S. Department of Energy), 2001a. *Remedial Action Plan for the Pinellas 4.5 Acre Site*, U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, July.

DOE (U.S. Department of Energy), 2001b. *Remediation Agreement for the Four and One-Half Acre Site in Largo, Pinellas County, Florida*, U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, January.

DOE (U.S. Department of Energy), 2003. *Pinellas Environmental Restoration Project Interim Remedial Action Plan for Ground Water Recovery at the 4.5 Acre Site*, GJO-2003-480-TAC, prepared by U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, August.

DOE (U.S. Department of Energy), 2004. *Pinellas Environmental Restoration Project Sampling Procedures for the Young - Rainey STAR Center and 4.5 Acre Site*, DOE-LM/GJ718-2004, prepared by U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, September.

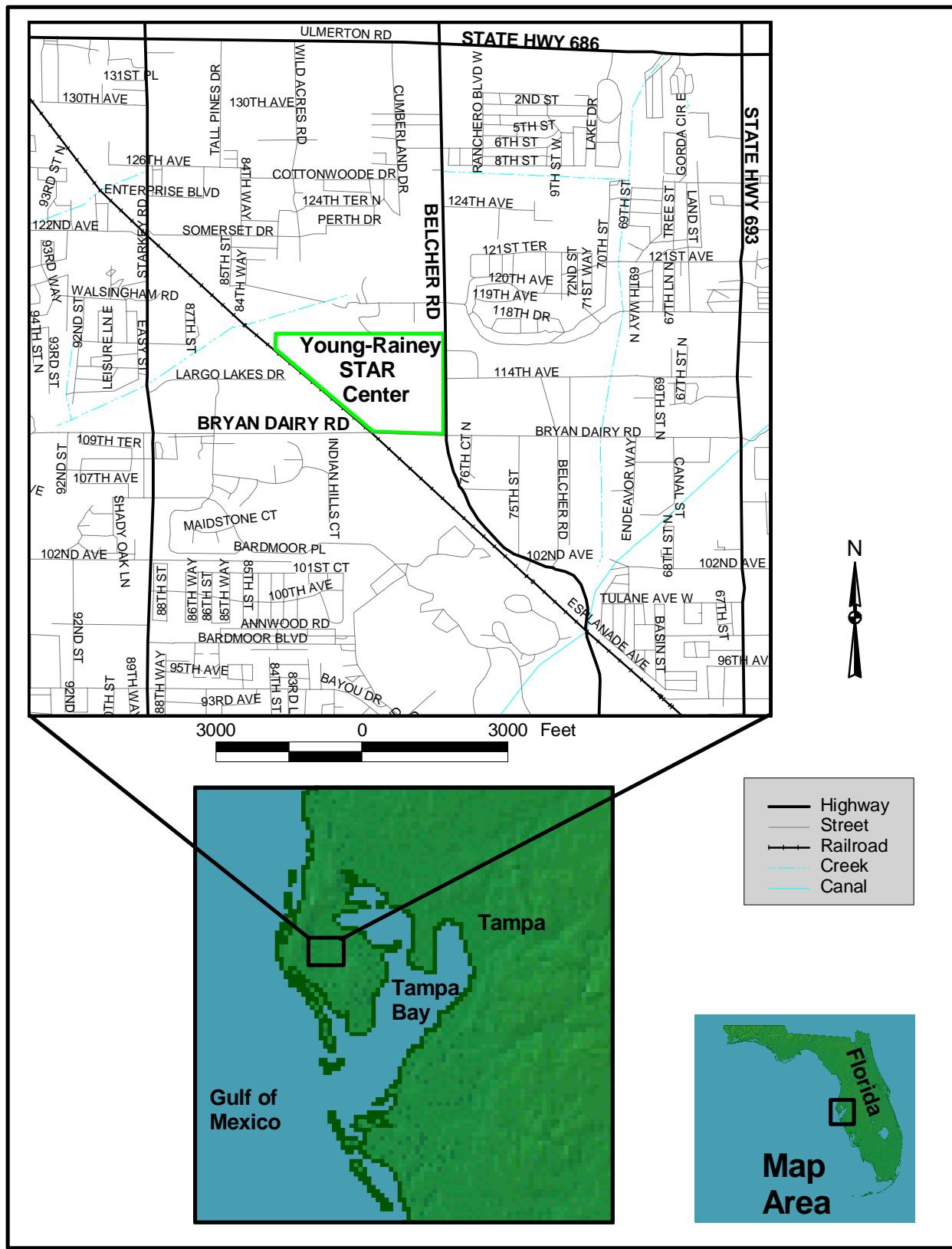


Figure 1. Young - Rainey STAR Center Location

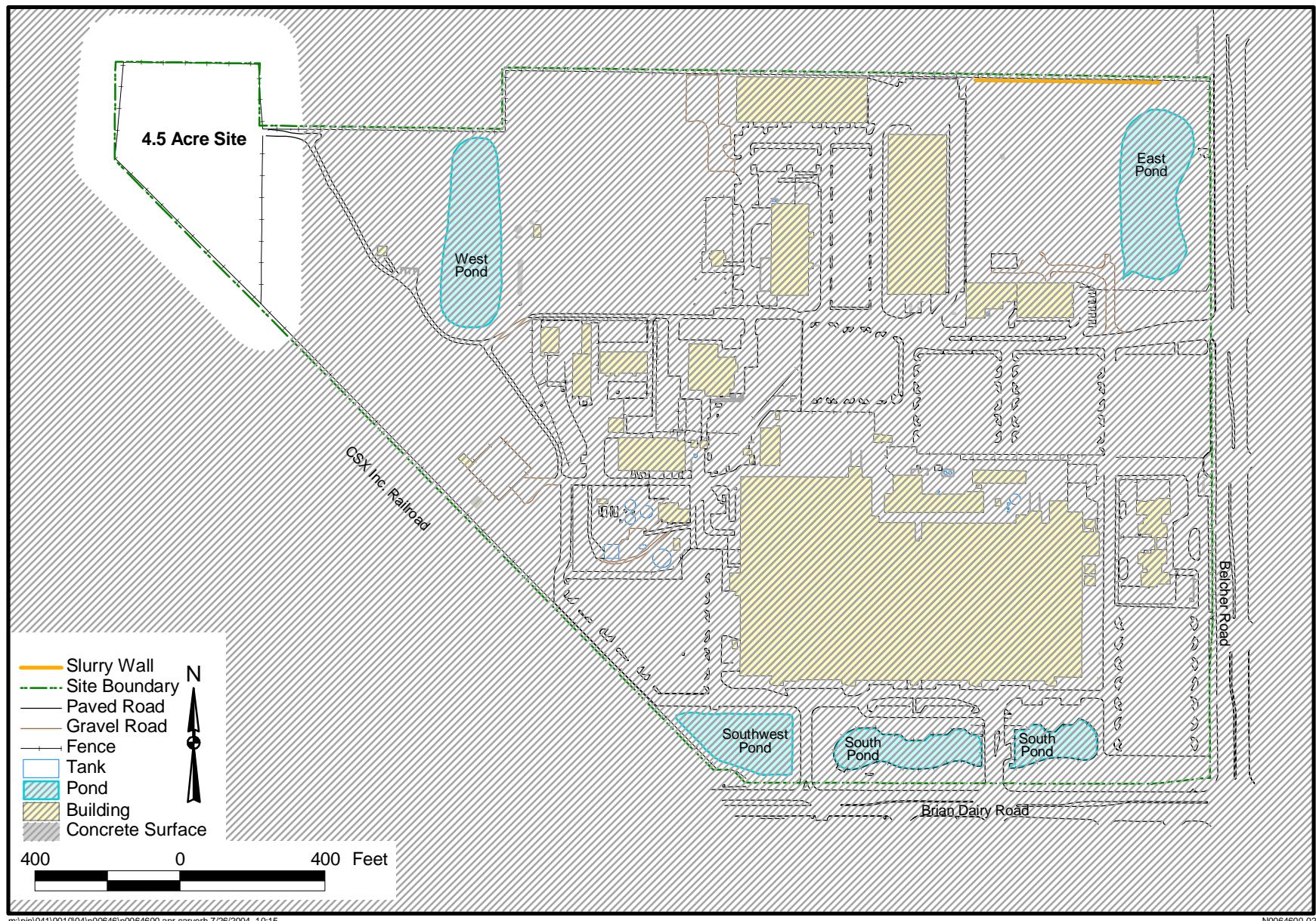


Figure 2. 4.5 Acre Site Location

N0064600-02

m:\pin\041\001\0104\h00646\h0064600.apr carverh 7/26/2004, 10:15

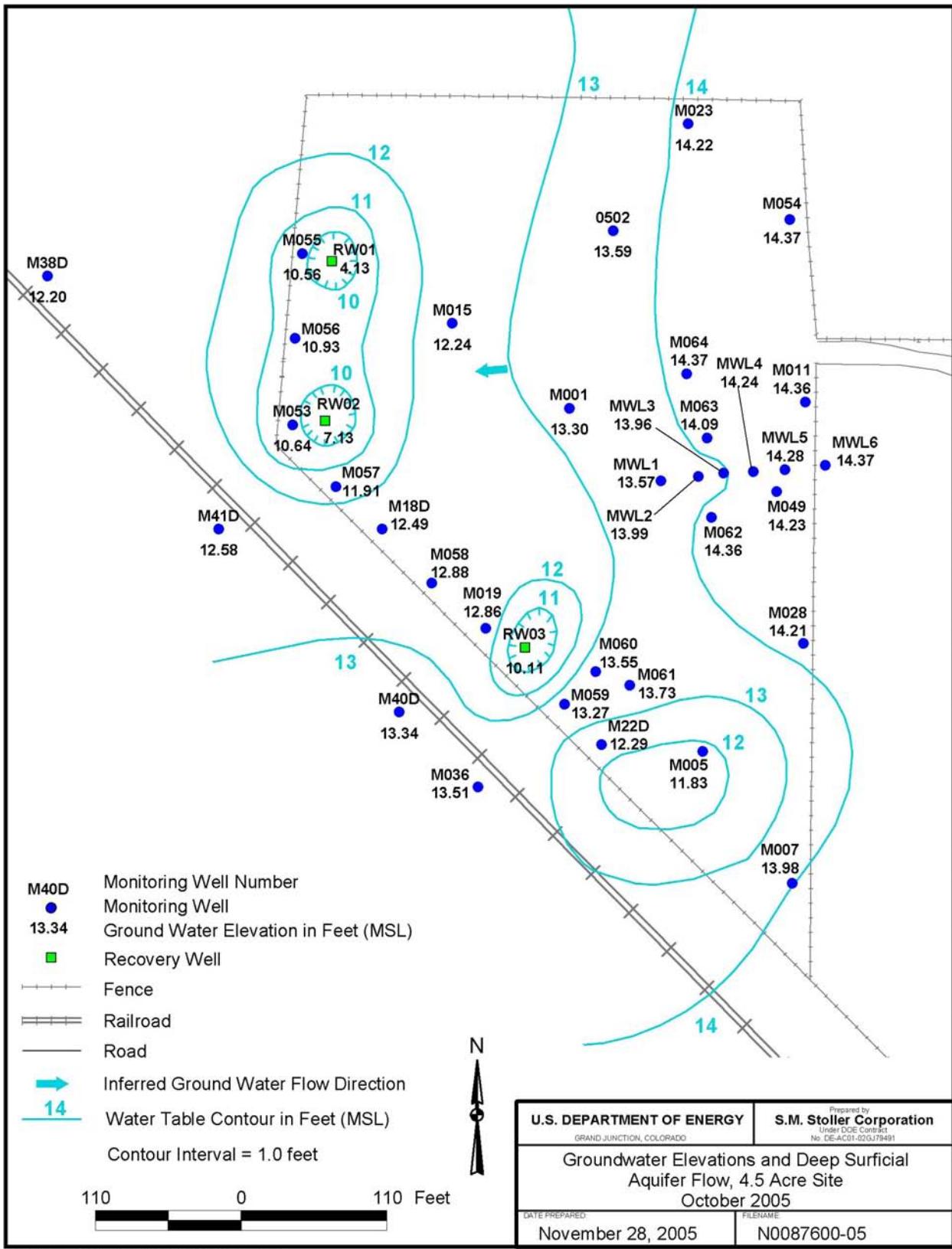


Figure 3. Ground Water Elevations and Deep Surficial Aquifer Flow, 4.5 Acre Site, October 2005

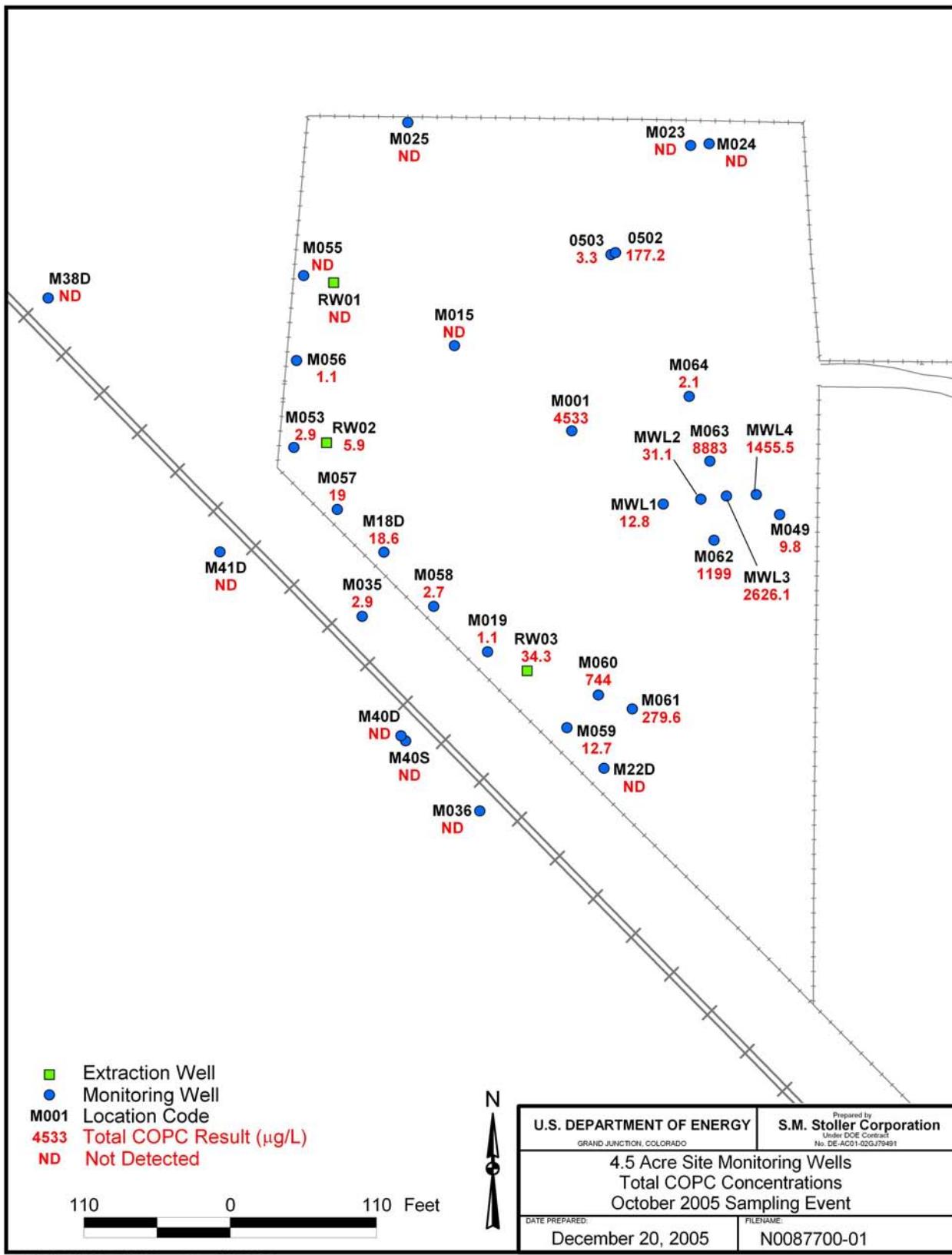


Figure 4. 4.5 Acre Site TCOPC Concentrations October 2005 Sampling Event

4.5 Acre Site Groundwater and Mass Removal

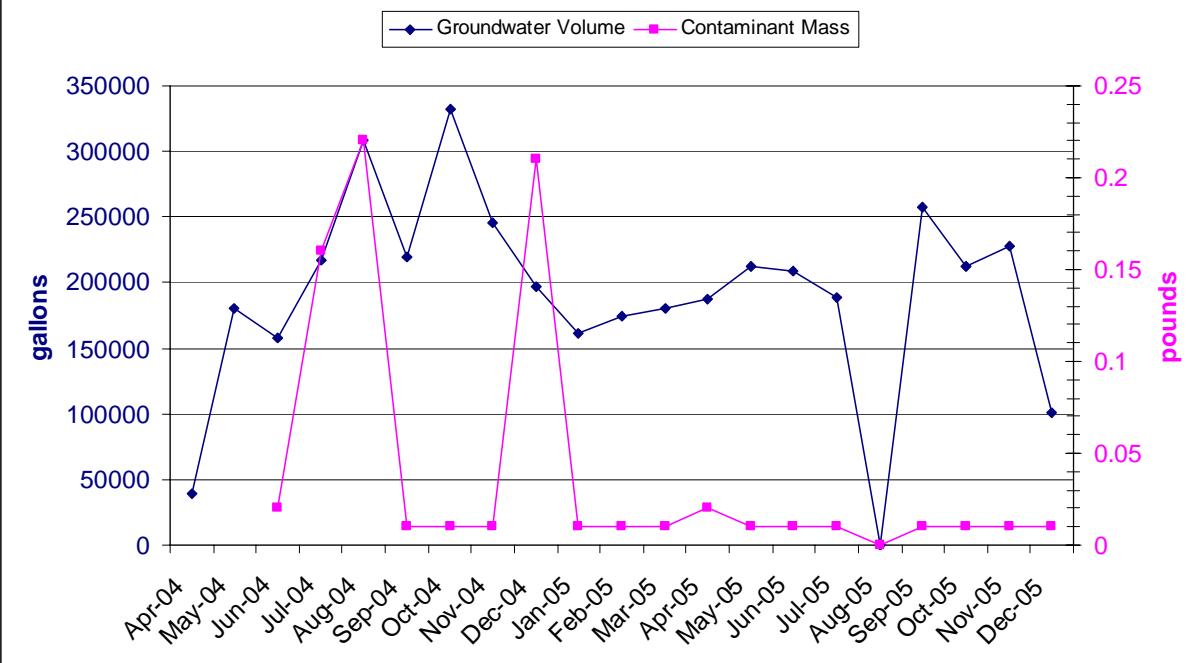


Figure 5. 4.5 Acre Site Ground Water Recovery and Mass Removal

Table 1. Water-Level Data at the 4.5 Acre Site

Location	Measurement		Water Depth From Land Surface (ft)	Ground Water Elevation (ft NGVD)
	Date	Time		
PIN05	Trench Site			
0500	10/14/2005	12:45	4.00	14.50
PIN20	4.5 Acre Site			
0502	10/14/2005	09:28	3.81	13.59
0503	10/14/2005	09:29	3.80	13.60
M001	10/14/2005	09:30	4.30	13.30
M003	10/14/2005	08:53	4.26	13.94
M005	10/14/2005	08:55	6.47	11.83
M007	10/14/2005	08:57	5.47	13.98
M011	10/14/2005	09:07	3.74	14.36
M012	10/14/2005	09:10	3.45	14.55
M015	10/14/2005	09:25	5.26	12.24
M019	10/14/2005	08:49	5.14	12.86
M023	10/14/2005	09:16	5.25	14.22
M024	10/14/2005	09:15	3.57	14.23
M025	10/14/2005	09:19	3.38	12.92
M028	10/14/2005	09:01	3.99	14.21
M035	10/14/2005	08:32	5.93	12.87
M036	10/14/2005	08:26	5.79	13.51
M049	10/14/2005	09:02	3.57	14.23
M053	10/14/2005	08:40	6.56	10.64
M054	10/14/2005	09:13	3.33	14.37
M055	10/14/2005	09:23	6.84	10.56
M056	10/14/2005	08:37	6.17	10.93
M057	10/14/2005	08:44	5.99	11.91
M058	10/14/2005	08:48	4.82	12.88
M059	10/14/2005	08:50	4.53	13.27
M060	10/14/2005	10:00	3.78	13.55
M061	10/14/2005	09:56	3.55	13.73
M062	10/14/2005	09:53	3.47	14.36
M063	10/14/2005	09:43	4.01	14.09
M064	10/14/2005	09:46	3.34	14.37
M18D	10/14/2005	08:45	5.21	12.49
M22D	10/14/2005	08:53	5.51	12.29
M38D	10/14/2005	08:15	6.30	12.20
M40D	10/14/2005	08:23	6.06	13.34
M40S	10/14/2005	08:22	5.71	13.49
M41D	10/14/2005	08:19	6.52	12.58
MWL1	10/14/2005	09:32	4.67	13.57
MWL2	10/14/2005	09:35	3.78	13.99
MWL3	10/14/2005	09:37	3.74	13.96
MWL4	10/14/2005	09:40	3.50	14.24
MWL5	10/14/2005	09:04	4.29	14.28
MWL6	10/14/2005	09:50	4.08	14.37

Table 1 (continued). Water-Level Data at the 4.5 Acre Site

Location	Measurement		Water Depth From Land Surface (ft)	Ground Water Elevation (ft NGVD)
	Date	Time		
RW01	10/14/2005	08:49	13.47	4.13
RW02	10/14/2005	08:57	9.97	7.13
RW03	10/14/2005	08:55	7.49	10.11

Table 2. Field Measurements of Samples Collected at the 4.5 Acre Site

Location	Screen Depth (ft bbls)	Temperature (°C)	Specific Conductance (µmhos/cm) ^a	Turbidity (NTU)	pH	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/L)
PIN20				4.5 Acre Site			
0502	21.2–31.2	25.85	1,183	18.4	6.61	115	0.3
0503	13.2–23.2	25.9	1,593	38.4	6.62	-75.9	0.73
M001	20–25	25.51	1,393	3.71	6.58	-73.3	5.97
M015	20.8–25.8	26.6	758	4.2	6.78	-92	0.55
M019	22–27	27.3	1,549	19.3	6.75	-72	1.69
M023	19.8–24.8	26.5	941	10.1	6.72	-96	0.59
M024	8.7–13.7	27.6	800	8.1	6.67	-67.8	0.65
M025	8.6–13.6	26.4	2,229	11.8	6.57	-60.9	0.61
M035	9–14	26.24	2,244	2.95	6.6	34.8	0.4
M036	25–30	24.8	825	3.9	6.75	-77.9	0.65
M049	20–30	25.2	1,092	17.5	6.69	-77.5	0.98
M053	20–30	25.3	1,053	60.4	6.8	-96.8	0.53
M055	21–31	26.6	1,047	13.5	6.77	-18.2	0.5
M056	19–29	25.6	970	132	6.77	-78.8	0.66
M057	20–30	26.28	1,385	13	6.74	-3.7	0.23
M058	18–28	25.8	1,372	67.6	6.76	-76.8	0.6
M059	19–29	25.63	1,162	26.7	6.8	-79	4.83
M060	18–28	28.59	753	24.8	6.84	-112.2	1.7
M061	20–30	26.3	808	14.7	6.85	-94.3	2.1
M062	20–30	25.04	2,237	10.8	6.5	42.5	0.24
M063	19.5–29.5	25.83	2,362	281	6.31	-97.9	7.76
M064	15–25	26.8	3,062	237	6.36	-16.1	0.43
M18D	20–30	25.5	1,584	10.4	6.77	-84.7	0.55
M22D	20–30	25.5	1,835	6.1	6.67	-82.3	0.63
M38D	20–30	25.3	784	2.5	6.88	-76.3	0.6
M40D	18–28	25	974	11.5	6.8	-101.3	0.6
M40S	4–14	27.2	202	19.6	6.21	120.9	2.26
M41D	16–26	25	1,646	5.9	6.67	-78.1	0.65
MWL1	21–26	26.1	2,574	12.8	5.95	-30.1	1.01
MWL2	21–26	27.4	2,789	11.6	6.5	-76.7	0.69
MWL3	21–26	26.1	1,808	7.5	6.39	-73.4	0.87
MWL4	20.8–25.8	27.5	865	7.6	6.71	-81.4	0.73

^aTemperature corrected to 25°C.

*Table 3. COPC Concentrations from Wells at the 4.5 Acre Site^a
(reported in micrograms per liter)*

Location	Screen Depth (ft)	Date Sampled	TCE	cis-1,2-DCE	trans-1,2-DCE	Total 1,2-DCE ^b	Vinyl chloride	Benzene	Total COPC ^c
FDEP MCL			3	70	100	63	1	1	
PIN20 4.5 Acre Site									
0502	21.2–31.2	10/12/2004	<2.5	106	<2.5	106	209	<2.5	315
		4/14/2005	<0.5	148	<0.5	148	225	<0.5	373
		10/12/2005	<0.5	67.2	0.61J	67.2	110	<0.5	177.2
0503	13.2–23.2	10/12/2004	<0.5	<0.5	<0.5	ND	3.2	<0.5	3.2
		4/6/2005	<0.5	<0.5	<0.5	ND	4.2	<0.5	4.2
		10/12/2005	<0.5	0.75J	<0.5	0.75J	3.3	<0.5	3.3
M001	20–25	10/14/2004	21.4	1,120	87.7	1,207.7	1,580	<10	2,809.1
		4/14/2005	43.7	1,900	161	2,061	1,940	<10	4,044.7
		10/11/2005	<100	2,050	243	2,293	2,240	<100	4,533
M003	9–14	4/7/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M005	25.8–30.7	4/7/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M007	25.3–30.3	4/12/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M011	23.7–28.7	4/8/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M012	8.6–13.6	4/8/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M015	20.8–25.8	10/15/2004	<0.5	<0.5	<0.5	ND	0.8J	<0.5	ND
		4/11/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		10/11/2005	<0.5	<0.5	<0.5	ND	0.64J	<0.5	ND
M019	22–27	10/14/2004	<0.5	1.3	<0.5	1.3	1.4	<0.5	2.7
		1/13/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/11/2005	<0.5	1.3	<0.5	1.3	<0.5	<0.5	1.3
		7/14/2005	<0.5	1.7	<0.5	1.7	<0.5	<0.5	1.7
		10/11/2005	<0.5	1.1	<0.5	1.1	0.64J	<0.5	1.1
M023	19.8–24.8	10/12/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/6/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		10/10/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M024	8.7–13.7	10/13/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/6/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		10/10/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M025	8.6–13.6	10/12/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/6/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		10/10/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M028	22–27	4/13/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M035	9–14	10/7/2004	<0.5	1.4	<0.5	1.4	<0.5	<0.5	1.4
		1/12/2005	<0.5	2.9	<0.5	2.9	<0.5	<0.5	2.9
		4/7/2005	<0.5	2	<0.5	2	<0.5	<0.5	2
		7/14/2005	<0.5	2.2	<0.5	2.2	<0.5	<0.5	2.2
		10/11/2005	<0.5	2.9	<0.5	2.9	<0.5	<0.5	2.9
M036	25–30	10/7/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/7/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		10/12/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND

Table 3 (continued). COPC Concentrations from Wells at the 4.5 Acre Site
(reported in micrograms per liter)

Location	Screen Depth (ft)	Date Sampled	TCE	cis-1,2-DCE	trans-1,2-DCE	Total 1,2-DCE ^b	Vinyl chloride	Benzene	Total COPC ^c
FDEP MCL			3	70	100	63	1	1	
M049	20–30	10/14/2004	<0.5	7.7	0.69J	7.7	4.8	<0.5	12.5
		4/8/2005	<0.5	7.1	0.61J	7.1	4.2	<0.5	11.3
		10/12/2005	<0.5	7.1	0.62J	7.1	2.7	<0.5	9.8
M053	20–30	10/14/2004	<0.5	<0.5	<0.5	ND	5.1	<0.5	5.1
		1/12/2005	<0.5	<0.5	<0.5	ND	5	<0.5	5
		4/14/2005	<0.5	<0.5	<0.5	ND	5.2	<0.5	5.2
		7/14/2005	<0.5	<0.5	<0.5	ND	5.3	<0.5	5.3
		10/11/2005	<0.5	<0.5	<0.5	ND	2.9	<0.5	2.9
M054	20–30	4/6/2005	<1	<1	<1	ND	<1	<1	ND
M055	21–31	10/13/2004	<0.5	<0.5	<0.5	ND	0.8J	<0.5	ND
		1/12/2005	<0.5	<0.5	<0.5	ND	0.56J	<0.5	ND
		4/6/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		7/14/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		10/10/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M056	19–29	10/14/2004	<0.5	<0.5	<0.5	ND	5.5	<0.5	5.5
		1/12/2005	<0.5	<0.5	<0.5	ND	3	<0.5	3
		4/7/2005	<0.5	<0.5	<0.5	ND	3.4	<0.5	3.4
		7/14/2005	<0.5	<0.5	<0.5	ND	1.9	<0.5	1.9
		10/11/2005	<0.5	<0.5	<0.5	ND	1.1	<0.5	1.1
M057	20–30	10/14/2004	<0.5	8.4	<0.5	8.4	4.6	<0.5	13
		1/12/2005	<0.5	11.4	<0.5	11.4	3.5	<0.5	14.9
		4/7/2005	<0.5	9.5	<0.5	9.5	3.1	<0.5	12.6
		7/14/2005	<0.5	15.1	<0.5	15.1	3.6	<0.5	18.7
		10/11/2005	<0.5	16	<0.5	16	3	<0.5	19
M058	18–28	10/14/2004	<0.5	2.9	<0.5	2.9	2.3	<0.5	5.2
		1/12/2005	<0.5	1.9	<0.5	1.9	1	<0.5	2.9
		4/7/2005	<0.5	1.8	<0.5	1.8	1.2	<0.5	3
		7/14/2005	<0.5	3	<0.5	3	2.1	<0.5	5.1
		10/11/2005	<0.5	1.5	<0.5	1.5	1.2	<0.5	2.7
M059	19–29	10/14/2004	<0.5	6.1	0.99J	6.1	47.3	<0.5	53.4
		1/12/2005	<0.5	2.8	0.64J	2.8	27.7	<0.5	30.5
		4/7/2005	<0.5	1	<0.5	1	16	<0.5	17
		7/14/2005	<0.5	0.97J	<0.5	0.97J	8.1	<0.5	8.1
		10/11/2005	<0.5	1.3	<0.5	1.3	11.4	<0.5	12.7
M060	18–28	10/13/2004	1.7	76.7	27	103.7	455	<0.5	560.4
		1/13/2005	2.4	977	136	1,113	745	<0.5	1,860.4
		4/14/2005	2.5	1,300	123	1,423	361	<0.5	1,786.5
		7/19/2005	<0.5	102	23.4	125.4	75.2	<0.5	200.6
		10/12/2005	<0.5	355	109	464	280	<0.5	744
M061	20–30	10/13/2004	14.3	37.9	19	56.9	520	<0.5	591.2
		1/13/2005	18.5	28.4	6.7J	28.4	253	<5	299.9
		4/13/2005	89.9	116	9.9	125.9	167	<0.5	382.8
		7/18/2005	623	377	24.2	401.2	505	<0.5	1,529.2
		10/12/2005	35.2	20.4	<2.5	20.4	224	<2.5	279.6

Table 3 (continued). COPC Concentrations from Wells at the 4.5 Acre Site
(reported in micrograms per liter)

Location	Screen Depth (ft)	Date Sampled	TCE	cis-1,2-DCE	trans-1,2-DCE	Total 1,2-DCE ^b	Vinyl chloride	Benzene	Total COPC ^c
FDEP MCL			3	70	100	63	1	1	
M062	20–30	10/15/2004	<0.5	1,190	9.9	1,199.9	2,310	1.2	3,511.1
		1/13/2005	<0.5	2,840	11.8	2,851.8	4,480	1.5	7,333.3
		4/8/2005	<10	538	<10	538	964	<10	1,502
		7/14/2005	<0.5	778	10	788	1,770	1.3	2,559.3
		10/12/2005	<10	372	<10	372	827	<10	1,199
M063	19.5–29.5	10/13/2004	5,930	8,160	562	8,722	3,100	1.2	17,753.2
		1/13/2005	4,290	9,610	486	10,096	3,450	<50	17,836
		4/13/2005	2,420	7,230	325	7,555	2,750	0.94J	12,725
		7/15/2005	984	2,440	127	2,567	788	0.93J	4,339
		10/10/2005	2,000	4,890	273	5,163	1,720	<100	8,883
M064	15–25	10/14/2004	<0.5	1	<0.5	1	9.4	<0.5	10.4
		1/13/2005	<0.5	3.5	<0.5	3.5	14.2	<0.5	17.7
		4/14/2005	<0.5	0.9J	<0.5	0.9J	5.9	<0.5	5.9
		7/15/2005	<0.5	2.1	<0.5	2.1	8.4	<0.5	10.5
		10/10/2005	<0.5	<0.5	<0.5	ND	2.1	<0.5	2.1
M18D	20–30	10/14/2004	<0.5	13.3	<0.5	13.3	6.9	<0.5	20.2
		1/12/2005	<0.5	15	<0.5	15	5.8	<0.5	20.8
		4/13/2005	<0.5	16.2	<0.5	16.2	4.1	<0.5	20.3
		7/14/2005	<0.5	13.6	0.55J	13.6	6.8	<0.5	20.4
		10/11/2005	<0.5	14.7	0.67J	14.7	3.9	<0.5	18.6
M22D	20–30	10/14/2004	<0.5	<0.5	<0.5	ND	1.4	<0.5	1.4
		1/12/2005	<0.5	<0.5	<0.5	ND	1.3	<0.5	1.3
		4/7/2005	<0.5	<0.5	<0.5	ND	0.89J	<0.5	ND
		7/14/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		10/11/2005	<0.5	<0.5	<0.5	ND	0.67J	<0.5	ND
M38D	20–30	10/7/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/7/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		10/11/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M40D	18–28	10/7/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/7/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		10/12/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M40S	4–14	10/7/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/7/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		10/12/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
M41D	16–26	10/7/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/7/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		10/11/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
MWL1	21–26	10/15/2004	<0.5	<0.5	<0.5	ND	5.4	6.1	11.5
		4/8/2005	<0.5	<0.5	<0.5	ND	43.2	5.6	48.8
		10/12/2005	<0.5	<0.5	<0.5	ND	9.4	3.4	12.8
MWL2	21–26	10/14/2004	<0.5	23.7	23.8	47.5	124	0.74J	171.5
		4/8/2005	<0.5	7.7	10.7	18.4	58.4	0.52J	76.8
		10/12/2005	<0.5	3.8	6.5	10.3	20.8	<0.5	31.1

Table 3 (continued). COPC Concentrations from Wells at the 4.5 Acre Site
(reported in micrograms per liter)

Location	Screen Depth (ft)	Date Sampled	TCE	cis-1,2-DCE	trans-1,2-DCE	Total 1,2-DCE ^b	Vinyl chloride	Benzene	Total COPC ^c
FDEP MCL			3	70	100	63	1	1	
MWL3	21–26	10/13/2004	<0.5	224	1.7	225.7	2,820	<0.5	3,045.7
		4/13/2005	0.61J	348	4.5	352.5	2,560	<0.5	2,912.5
		10/12/2005	1	299	6.1	305.1	2,320	<0.5	2,626.1
MWL4	20.8–25.8	10/13/2004	84.5	1,940	75.9	2,015.9	498	<0.5	2,598.4
		4/13/2005	78.3	1,730	45.3	1,775.3	371	<0.5	2,224.6
		10/12/2005	43.6	1,070	35.9	1,105.9	306	<0.5	1,455.5
MWL5	20.8–25.8	10/14/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/8/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
MWL6	21.5–26.5	10/15/2004	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
		4/11/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND
RW01	10–30	10/5/2004	<0.5	2	<0.5	2	1.3	<0.5	3.3
		1/6/2005	<0.5	2.1	<0.5	2.1	1.3	<0.5	3.4
		4/6/2005	<0.5	1.7	<0.5	1.7	1.3	<0.5	3
		7/6/2005	<0.5	1.3	<0.5	1.3	1.2	<0.5	2.5
		10/4/2005	<0.5	0.99J	<0.5	0.99J	0.72J	<0.5	ND
RW02	8–28	10/5/2004	<0.5	2.3	<0.5	2.3	3.2	<0.5	5.5
		1/6/2005	<0.5	3.3	<0.5	3.3	2.6	<0.5	5.9
		4/6/2005	<0.5	3.1	<0.5	3.1	3.5	<0.5	6.6
		7/6/2005	<0.5	2.3	<0.5	2.3	2	<0.5	4.3
		10/4/2005	<0.5	3	<0.5	3	2.9	<0.5	5.9
RW03	8–28	10/5/2004	<0.5	1.8	1.4	3.2	9.5	<0.5	12.7
		1/6/2005	<0.5	2.5	1.9	4.4	9.2	<0.5	13.6
		4/6/2005	<0.5	2.8	2.3	5.1	20.1	<0.5	25.2
		7/6/2005	<0.5	3.6	1.8	5.4	14.3	<0.5	19.7
		10/4/2005	<0.5	11.5	2.9	14.4	19.9	<0.5	34.3

^aBefore December 18, 2003, "<" values are reporting limits. On or after December 18, 2003, "<" values are method detection limits.

^bTotal 1,2-DCE is the sum of cis-1,2-DCE and trans-1,2-DCE.

^cTotal COPC is the sum of the individual COPC concentrations. The cis-1,2-DCE and trans-1,2-DCE values are not part of the total COPC value because these values are included in the total 1,2-DCE value. "J" values are not included in the total COPC value.

ND = Not detected.

J = Estimated value, result is between the reporting limit and the method detection limit.

Arsenic, while a COPC, is not included in this table, nor in the Total COPC value.

Table 4. Arsenic Concentrations from Wells at the 4.5 Acre Site

Location	Sample Date	Concentration (mg/L)
0502	10/12/2005	0.0128
0503	10/12/2005	0.0303

B = Inorganic result is between the IDL and CRDL.

"<" values are method detection limits.

Table 5. Dissolved Gas and Bacteria

Location	Date Sampled	Ethane (µg/L)	Ethene (µg/L)	Hydrogen (nmol/L)	Methane (µg/L)	Carbon dioxide (mg/L)	Dehalococcoides ethenogenes (copy numbers/L)	
4.5 Acre Site								
PIN20	0502	10/12/2005	13	1.5	0.78	1,000	81	119,000,000
	M001	10/11/2005	67	48	0.99	1,200	94	2,280,000
	M035	10/11/2005	0.016	0.012	8	160	59	Present
	M057	10/11/2005	0.012	0.03	1.5	680	50	89,500,000
	M059	10/11/2005	0.5	0.15	1.2	740	56	4,240,000
	M060	10/12/2005	28	140	1.5	1,200	56	59,300,000
	M061	10/12/2005	0.012	16	2.5	1,300	51	6,880,000
	M062	10/12/2005	1.1	23	1.8	730	74	10,700,000
	M063	10/10/2005	25	63	1.1	270	130	1,500,000
	M064	10/10/2005	0.6	0.028	2.4	78	110	Present

Table 6. RPD for Duplicate Samples, 4.5 Acre Site

Sample ID	Duplicate ID	Case Number	Constituent	S ^a	D ^b	RPD Value	5 times DL ^c	Fail ^d
PIN20-0502	PIN24-0506	F35725	1,1-Dichloroethene	0.51	0.25	68.4	0.5	2.5
			Arsenic	0.0128	0.0122	4.8	0.0029	0.0145
			cis-1,2-Dichloroethene	67.2	67.8	0.9	0.5	2.5
			trans-1,2-Dichloroethene	0.61	0.63	3.2	0.5	2.5
			Vinyl chloride	110	115	4.4	1	5
<hr/>								
PIN20-M058	PIN24-0507	F35639	cis-1,2-Dichloroethene	1.5	1.5	0.0	0.5	2.5
			Vinyl chloride	1.2	1.2	0.0	0.5	2.5
PIN20-MWL1	PIN24-0508	F35725	Benzene	3.4	3.4	0.0	0.5	2.5
			Vinyl chloride	9.4	9.3	1.1	0.5	2.5

^aS = Original sample (N001), VOC concentration in $\mu\text{g}/\text{L}$.

^bD = Duplicate sample (N002), VOC concentration in $\mu\text{g}/\text{L}$.

^cDL = Detection limit.

^dFail is an RPD greater than $\pm 30\%$ and an original or duplicate sample more than 5 times the detection limit.

*Table 7. Summary of Analytical Results for the 4.5 Acre Site Treatment System
(reported in micrograms per liter unless otherwise noted)^a*

Location ^b	Date Sampled	TCE	cis-1,2-DCE	trans-1,2-DCE	Total 1,2-DCE ^c	Vinyl chloride	Benzene	Total COPC ^d	CaCO ₃ mg/L	Fe mg/L
PIN20	4.5 Acre Site									
TRTI	10/4/2005	0.59J	3.2	<0.5	3.2	3.4	<0.5	6.6	860	6.16
	11/3/2005	<0.5	2.9	<0.5	2.9	2.3	<0.5	5.2	941	9.15
	12/5/2005	<0.5	4.2	0.52J	4.2	3.4	<0.5	7.6	911	6.61
TRTE	10/4/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND	867	6.22
	11/3/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND	942	9.16
	12/5/2005	<0.5	<0.5	<0.5	ND	<0.5	<0.5	ND	913	6.69

^a"<" values are method detection limits.

^bTRTI is the system influent and TRTE is the system effluent.

^cTotal 1,2-DCE is the sum of cis-1,2-DCE and trans-1,2-DCE.

^dTotal COPC is the sum of the individual COPC concentrations. The cis-1,2-DCE and trans-1,2-DCE values are not part of the total COPC value because this value is included in the total 1,2-DCE value. "J" values are not included in the total COPC value.

J = Estimated value, result is between the reporting limit and the method detection limit.

ND = Not detected.

*Table 8. Estimated Mass of VOCs Recovered from the 4.5 Acre Site Recovery Wells
During October, November, and December 2005*

Month	Volume Treated (gallons)	Concentration ^a						
		cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	Toluene (µg/L)	TCE (µg/L)	Methylene Chloride (µg/L)	Vinyl Chloride (µg/L)	
October 2005	212,940	3.20	0.25	0.25	0.59	3.40	0.50	8.19
November 2005	227,510	2.90	0.25	0.25	0.25	2.30	0.50	6.45
December 2005	101,268	4.20	0.52	0.25	0.25	3.40	0.50	9.12

Month	Volume Treated (gallons)	Mass Recovered ^b						
		cis-1,2-DCE (lbs)	trans-1,2-DCE (lbs)	Toluene (lbs)	TCE (lbs)	Methylene Chloride (lbs)	Vinyl Chloride (lbs)	
October 2005	212,940	0.01	0.00	0.00	0.00	0.00	0.01	0.01
November 2005	227,510	0.01	0.00	0.00	0.00	0.00	0.00	0.01
December 2005	101,268	0.00	0.00	0.00	0.00	0.00	0.00	0.01

^aThese concentrations represent the average of monthly sampling results.

^bIncludes "J" (estimated) values. For any detection of "<", which indicates the laboratory could not detect that analyte, 50 percent of the "<" value was used for the calculation of recovery.

Appendix A

Laboratory Reports—October 2005 Quarterly Results

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Appendix B

Laboratory Reports for 4.5 Acre Site Treatment System— October through December 2005

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